

Species of the South American *Astragalus garbancillo* (Leguminosae-Papilionoideae) complex

EDITH GÓMEZ-SOSA

Instituto de Botánica Darwinion,

Labardén 22, Casilla 22

San Isidro, Prov. Buenos Aires

ARGENTINA

Abstract

The species *Astragalus garbancillo* Cav. grows from Northern Peru and Bolivia to central western Argentina, between 1600-4500 m elevation. This taxonomic study revealed a relationship among *A. garbancillo* var. *mandoni* (Rusby) Macbride resurrected and lectotypes designated, *A. pickeringii* Gray, *A. romasanus* Ulbrich, with lectotypes here designated, and *A. varus* (Macbride) Gómez-Sosa, nov. com. These four species and a variety are described, illustrated for the first time and differentiated in the included keys. They are South American's species consequently there are a Spanish key enclosed. Ecological characteristics and toxic properties are given, and distribution maps are provided.

Resumen

A. garbancillo Cav. crece desde el N de Perú y Bolivia al centro oeste de Argentina, entre los 1600-4500 m de altura. Este estudio taxonómico establece las relaciones con *A. garbancillo* var. *mandoni* (Rusby) Macbride, restablecido y lectotipificado, *A. pickeringii* Gray, *A. romasanus* Ulbrich, con lectotipus designados en esta oportunidad, y *A. varus* (Macbride) Gomez-Sosa, nov. com. Estas cuatro especies y una variedad están actualizadamente descriptas, ilustradas y diferenciadas por primera vez e incluidas en una clave. Estas son especies de América del Sur por lo tanto se aporta una Clave de identificación en español. Además se dan características ecológicas, propiedades tóxicas y mapas de distribución.

Introduction

A. garbancillo was first collected in 1777-1778 by the Spanish botanists Hipólito Ruiz and José Pavón, and by the Frenchman Joseph Dombey. The same species was named *A. unifultus* by L'Heritier, and this nomenclatural problem clarified by Gomez-Sosa, (1999 ; 2001).

This species was the first South American *Astragalus* to be described. Perhaps the reason was because of interest in collecting useful plants (Gomez-Sosa, 1999). In the protologue Cavanilles (1791) noted «Haec planta vulgo Garbancillo dicta amento est valde noxia, dicente D. Iosepho Pavon.» *Astragalus garbancillo* Cavanilles, is known has several common names in Argentina: garbanzo, garbancillo, yerba loca, hierba loca; likewise in Perú: garbancillo (Soukup, 1970); and in the Quechua idiom: huscja (Weberbauer, 1911), joscka (Yacovleff & Herrera, 1935), q'ira (Franquemont et al, 1990).

There are several ethnobotanical reports from Cusco (Peru) where it grows abundantly, of a harmful plant called garbancillo which produces blindness and death in horses. It has been reported to cause a bad taste in sheep meat and milk (Raimondi, 1857). Furthermore, Tschudi (1846), Herrera (1940), and Burkart (1952) cited this species as very toxic, and to have caused livestock losses.

Williams and Gómez-Sosa (1986) reported that *A. garbancillo* possess synthesized nitrogen compounds that hydrolyze to highly toxic 3-nitro-propanol (3-NPOH). Nitrocompounds are particularly toxic because they are rapidly absorbed into the circulatory system.

The group of species treatment under *A. garbancillo* complex, have in common principally the external view and coriaceous consistency of the fruit, in addition to the vegetative general aspect. Consequently, until now in herbarium's collection all these species related, have been wrongly named under *A. garbancillo* name. This is because before the species here treated haven't a complete description, in special the fruit consideration about the types of invagination.

This paper only has the objective to give a more complete and clear treatment of this small group of species, without any relationship between different South American groups, still in study.

A. garbancillo with the pod erect, coriaceous, subbilocular with incomplete membranaceous septum, is the hallmark of this otherwise widespread species. The apex apiculate keel-petals of *A. garbancillo* var. *mandoni* are distinctive in its range of dispersal.

Rusby (1893) described *A. mandoni* without fruit and any corolla's characteristic. After Macbride (1930) published *A. garbancillo* var. *mandoni* (Rusby) Macbride, without description and material, and then (1943) described *A. garbancillo* with synonymy *A. mandoni* and *A. garbancillo* var. *mandoni*. I must be to point out in both treatments, omit the description about the keel petals and the fruit's invagination.

The study on material cited by Rusby: Bang 1022 and Mandon 709 show me the keel with the apex apiculate, the *A. garbancillo* var. *mandoni*'s characteristic, here lectotipified.. This resurrection of the variety is because this difference is of minor importance if we may judge of the variability in *A. garbancillo*.

In addition to the vegetative general aspect, the others species considerer here to be closely related to *A. garbancillo* are: *A. pickeringii* Gray, *A. romasanus* Ulbrich and *A. varus* (Macbride) Gomez-Sosa, nov. comb., endemics of Peru.

Macbride (1930) describe *A. garbancillo* var. *varus*, when he said “further collections may very problably showit to be a distinct species” in relation to *A. garbancillo*. Jhonston (1938) located *A. pickeringii* like synonyme’s species of *A. garbancillo* but litterally said “with remarkable characteristics to considere them an diferent species”. Later Macbride (1943) cited *A. garbancillo* but omit *A. garbancillo* var. *varus*.

A. varus is considerer principally a good species because the complete septum have at apex an apical sinus or loophole, where the seed go out in the maturity during the dissemination (see fig.8 M). The special difference with the fruits of the *A. pickeringii* and *A. romasanus* is that at the maturity the membranaceum septum open along the suture. Besides as distinguished from leaflets and corolla characteristics according the Key and general description for both species.

The present description to this species have been enclosed new characteristics for the best taxonomic identification. The information from the material collected was included complete in the list of the specimens examined.

For *Astragalus garbancillo* Cavanilles, Macbride (1943) considered as synonyms the formerly separate taxa *A. unifultus*, *A. mandoni* Rusby and *A. garbancillo* var. *mandoni* (Rusby) Macbride. Moreover Johnston (1947), included in the synonymy *A. benthamianus* Gillies and *A. minor* Clos. The re-evaluation of the *A. garbancillo* var. *mandoni* resulted in resurrection of the variety. Other Peruvian species considered here to be closely related to *A. garbancillo* are *A. peckeringii*, *A. romasanus* Ulbrich, and *A. varus* (Macbride) Gómez-Sosa, nov.comb.

The confused taxonomic treatment and the important toxic characteristics are the reasons I studied this problem for several years. This study was based on European and American herbarium collections and field studies from Peru to Argentina.

Key to the *Astragalus garbancillo* and related species

- 1a. Erect herbs with stems to 0.70(-1) m high. Legume gently incurved, truncate at base, inflexed below middle of pod, subbilocular, incomplete membranaceous septum.
 - 2a. Keel at apex obtuse.
A. garbancillo var. *garbancillo*
 - 2b. Keel at apex apiculate
A. garbancillo var. *mandoni*

1b. Decumbens herbs with incurved-ascending stems, ca. 0.20 m high. Legume straight, obtuse at base, bilocular with complete membranaceous septum until placentar suture.

3 a. Leaflets abaxial side pubescent and adaxial glabrous. Flowers with wings obtuse at apex. Legume contracted at apex, sericeous.

4 a. Flowers violet to light blue with banner emarginate not acuminate. Legume with complete septum without sinus.

A. romasanus

4 b. Flowers whitish with banner emarginate and short acuminate. Legume with complete septum with apical sinus.

A. varus

3 b. Leaflets with bouth side pubescent. Flowers with wings retuse at apex. Legume obtuse at apex, woolly pubescens .

A. pickeringii

Clave para *Astragalus garbancillo* y especies relacionadas

1 a. Hierbas erectas. Tallos de 0.70 (-1) m alt. Legumbre suavemente incurva, base truncada, subbilocular por sutura dorsal invaginada seguida por un falso semitabique membranoso que divide el lóculo en forma parcial..

2 a. Quilla obtusa.

A. garbancillo var. *garbancillo*

2 b. Quilla apiculada.

A. garbancillo var. *mandoni*

1 b. Hierbas decumbentes. Tallos de ca. 0.20 m alt. Legumbre recta, base obtusa, bilocular por sutura dorsal invaginada, seguida de un falso tabique membranoso que divide completamente el lóculo en 2.

3 a. Folíolos con superficie abaxial pubescente y adaxial glabra. Flores con alas de ápice obtuso. Legumbre apiculada hacia el ápice, serícea.

4 a. Flores violáceas a celestes con estandarte emarginado, sin apículo. Le-

gumbre con falso tabique completo sin abertura apical.

A. romasanus

4 b. Flores blanquecinas con estandarte emarginado, con apículo. Legumbre con falso tabique completo con abertura apical.

A. varus

3 b. Folíolos con ambas superficies pubescentes. Flores con alas de ápice retuso. Legumbre obtusa hacia el ápice, lanoso-pubescente.

A. pickeringii

Astragalus garbancillo Cavanilles, Icon 1: 59, t.85. Dec. 1791 (LECTOTYPE designated by Gomez-Sosa, 1999) (Fig. 1)

A. unifultus L'Heritier, Stirp. Nov. 168. 1791.

A. benthamianus Gillies, Hook. & Arn., Bot. Misc. 3: 187. 1832. TYPE: ARGENTINA. Mendoza, El Alto de los Manantiales, *Gillies s.n.* (HOLOTYPE: K, ISOTYPES: GH).

A. minor Clos, Gay, Fl. Chile 2 107-1846. Chile."Probably locality mistaken (Johnston, 1947). (HOLOTYPE: P).

Herbs or subshrub; stems ca. 0.70 (-1) m x 1-2.5 cm, villose-sericeous to glabrescent; stipules pubescent 1.5 cm, amplexicaulous and connate through more than half their length into a shortly bidentate sheath; **leaves** ca. 7 cm, including petiole ca. 1.5 cm; leaflets 27-31, short petiolate, articulate, opposite, elliptic to subcircular, obtuse to slightly retuse, sometimes minutely mucronate, ca. 0.7 x 0.4 cm, lanate to glabrous; peduncles 4-5 cm shorter than leaves; **racemes** 7-10- flowered; white bracts 4-6 mm; pedicels 0.5-1 mm; bracteoles 0; calyx ca. 5.5 mm, brown to black incanus lanose-villose, the campanulate tube ca. 3 mm, the subulate teeth subequal in length, ca. 2.5 mm; **petals** violet-light blue to white; banner recurved ca. 40°, ovate-emarginate, ca. 1.5 x 0.7 cm; wings elliptic, ca. 1.3 x 0.3 cm; keel ca. 1.1 cm, apex obtuse; ovary villose; style glabrous, the stigma capitate; ovules 6; pod (0.7-)1 x 0.3-4.5 cm, erect, stipitate or sessile, the stipe up to 1.5 mm, coriaceous, in profile oblong, truncate at base, contracted at apex into triangular-acuminate beak, ca. 1 mm, subbilocular, keeled ventrally at the suture, narrowly sulcate dorsally, the lateral faces flat or low-concave, canescently pubescent; the valves are inflexed below middle of pod, with a membranaceous septum to 1 mm wide, incomplete and emarginate in the beak; when ripe disarticulating from the receptacle, the androecium remaining, dehiscence apical; **seeds** 4(-6), reniform, 2 - 3 x 2.5 - 3 mm, the smooth testa pale brown, unmottled.

Selected specimens examined. PERU. Without locality, 1839-1840, *Gay 1217* (NY ex P).

AMAZONAS, Prov. Chachapoyas, Atuén (Chuquibamba), 3800 m, 18 Jul. 1995 (fl,fr), *Quipuscoa S. & Bardales 159* (SI).

ANCASH, from Catac to Laguna Kerococha, 17 March 1983, *Tovar 9544* (UMS); Prov. Bolognesi, Racrachacra (Caserío de Aquia) 3300-3600 m, May 1950, *Cerrate, E. 713* (SI); Pampa de Lampas, Chiquian, 4160 m, 2 May 1952, *Cerrate, E. 1474* (SI); Co. Murquish, Ticlos, 3700 m, 26 May 1962, *Cerrate, E. 3985* (SI); Prov. Carhuáz, Parque Nac. Huascarán, Cord. Blanca, Valle of the Río Marcara, road to Vicos 5 km above achancos on hill called Chopi Jirca, altitude 2875 m, common up to 3800 m, 14 March 1964, *Hutchinson 4387* (GH,K); Betwween Usacocha and Carhua Catac, *Hutchinson 4396* (UMS). Prov. Corongo, Ocshamarca, 3400 m, 25 Aug. 1990, *Lezama 066* (HAO). Prov. Huaylas, cerro Cunka and Auquispuquio, 320-3900 m, 6 April 1986, *Smith, D. 11910* (NY).

AYACUCHO, Prov. Lucanas, along road Puquio to Lucanas, 3200m, 3 Apr. 1942, *Matcalfe 30324* (GH). Prov Lucanas, up to Puquio, 3300-3400 m, 20 March 1949, *Ferreyra, R. 5505* (SI).

CAJAMARCA, Bambamarca road, 78°34'W, 7°05'S, 2900-3400 m, 17 Febr. 1983(fl,fr), *D.N.Smith & R.Vazquez M. 3434*(MO, SI). Cajamarca to Pacasmayo, 3140 m, 27 May 1994 (fl,fr), *Gomez-Sosa 455, with S. Leiva, M. Cavanillas, & I. Sánchez Vega* (SI). Cajamarca to Combayo, 3170 m, 1 June 1994 (fl,fr) *Gomez-Sosa 459 with S. Leiva & I. Sánchez Vega*. Prov. Celendín, Challuayaco, E paso Cumullca, 3550 m, 12 May 1984(fl), *Sanchez Vega & Cabanillas 3476* (HAO). Chumbivicas, Tuntuma ca. 5 km from Velille, road Colquemarca to Tuntuma, 3750 m, 17 Apr. 1987, *Percy Nuñez et al. 7959* (MO).

CUSCO, Huayoccarí to Yanacocha, Urubamba, NW Cusco, 14 February 1987, *Percy Nuñez & Galiano 7008* (SI); Urubamba, 112 km from Cusco, Machupichu and Camino del Inca, 16 March 1988, *Percy Nuñez & F. Luna 8856* (SI); Sacsacancha, San Jeronimo, 4220-4400 m, 6 January 1950 (fl), *Proaño S. s.n.* (USM). Prov. Cusco, Oct. 1839 - Feb. 1940, *Gay s.n.* (GH,ex P); 3300-3400 m, 8 May 1925, *Pennell 14199* (GH). Sacsahuaman, ca. 3550 m, 5 June 1994 (fl,fr), *Gomez-Sosa 480 & Molle A.*(SI); 3400-3500 m, 14 November 1955, *Cerrate, E. 2398* (SI); 14 November 1945, *Ferreyra, R. 17108* (SI).

HUANCAVELICA, Prov. Huancavelica, Caullapa 4 km W from Conaica, 400-4050 m, 18 March 1951, *Tovar, O. 228* (USM).

JUNIN, Prov. Pasco, vicinity of Oroya, 14 Jul 1914(fr), *J.Rose 18692* (NY); Puna between La Oroya and Tarma, 24 km W of Tarma, 3800 m, 11°27'S, 75°45'W, 29 Jan. 1983(fl), *Gentry et al. 39754* (MO); Cumbre de Co. Capillacocha, 4300-1400 m, 8 January 1949 (fl), *Ferreyra, R. 5185* (USM); between Oroya and Junin, 4100-4200 m, 10 January 1949 (fl), *Ferreyra R. 5264* (USM); Prurúm, 4300 m, 6 June 1948, *P. Aguilar s.n.* (USM) route to Tarma, 13,500 feet, 6 Nov. 1975 (fl), *C. Davidson 3363* (NY).

Prov. Tarma, between Tarma and Oroya, 4300-4400 m, 28 December 1976, *Ferreya*, R. 18764.

LA LIBERTAD, Prov. Bolivar, Colpacucho (Lomgotea-Unamen), 3550 m, 28 September 1989, *Sagástegui A. 14200* (NY);

Prov. Santiago de Chuco, Casahuara road of Huaygorra Valley, 3700m, 30 Nov. 1936 (fl,fr), *J. West 8164* GH); Santiago-Shoreyo road, 11 km from Santiago, 78° 14' W, 8° 09' S, 3620 m, 26 Aug. 1982 (fl,fr), *D. Smith 2318* (MO); Prov. Otuzco, 3350 m, 28 March 1991 (fl), *Sagástegui A. 14414* (HAO, NY); Cerro Ragache (Salpo), 3500 m, 23 May 1984, *Sagastegui A. et al. 11640* (NY); Prov. Pataz, Tayabamba-Huancaspata, 3400 m, 25 Jun. 1974(fr), *López M. & Sagástegui A. 8216* (NY).

LIMA, Río Blanco, 3000-3500 m, 15-17 April 1929, *Killip & Smith 21719* (MA 259933).

PUNO, Prov. Huancaré, Moho, 3900 m, 3 March 1948, *P. Aguilar 368* (USM); environs Puno, Puna 3900 m, 7 February 1948 (fl, fr), *P. Aguilar 005* (SI, USM 15049).

Selected Specimens examined BOLIVIA

BOLIVIA. Región Andina, 3800 m, 12 April 1919, *Buchtien 553* (NY).

LA PAZ, Prov. Aroma, Uiscachani, 3900 m, side of road, 13 December 1972, *R. Lara Rico 1017* (LPB); Prov. Camacho, Cantón Ambana, from Ambana to Llojillata, 300-3400 m, 19 December 1980, *Beck 4127* (NY); Prov. Loaiza, 75 km south of La Paz and 18 km to Sapahuaqui, *4150 m*, 18 January 1981, *Beck 6026* (SI). Prov. Ingavi, Huacullani, ca. Cumbre Lomas de Resapata, 4000 m, 7 February 1979, *Beck 283* (SI); Hacienda Lacaya, ca. 20 km NW of Tambillo, ca. Titicaca, 3850-3900 m, 18 January 1984, *Gentry, Solomon & Zardini 44354* (SI); Prov. Murillo. Vic. La Paz, in ravine, 4000 m, 26 Jan. 907, *Buchtien 63* (K); 3800 m, 12 Apr. 1919 (fl,fr); Achachicala route Richtung Chacaltaya, 3900 m, 11 May 1980(fl,fr), *Feverer 4176d* (NY); Puna. 16°26' S 68°08' W, 4100 m, 28 Febr. 1987 (fl,fr), *Solomon 16224* (MO,NY,SI). Quebrada Kolkha Khana to Estancia, 3700-4350 m, 2 May 1988, *Lewis, Marko 88580* (SI); Prov. Omasuyos, Jankho Amaya, route Huarina to Tiquina, 3820m, 25 Apr. 1980(fl,fr), *T. Feuerer 4094 a* (NY). 17 km NE of Tiquina, shores of Lago Titicaca, 16°10' S, 68°48' W, 3850 m, 3 Aug. 1981 (fr), *Solomon 5901* (MO,SI). Near Titicaca, 4192 m, 28 August 1901, *Williams, R.S. 2405* (NY); Isla del Sol, Lago Titicaca, 3840 m, March 1910 (fl,fr), *Buchtien 2871* (NY). Near Sirapaca, 3880 m, 6 March 1982 (fl,fr), *Fernandez Casas & Molero 6458* (NY). Hills on south side at Calacoto, 6°32' S, 68°05' W, 3300-3600 m, 20 Jan. 1982 (fl), *Solomon 6737* (MO,SI). Prov. Manco Kapac, Co. Kantukkollu, 4030m, 2 May 1985 (fr), *T. Feuerer 22966 a* (NY).

POTOSÍ, Prov. Pasco, Uyuni, 3700 m, 24 March 1921, *Asplund 3092* (GH), Calderillo, 6 Jan. 1904, *Fiebrig 2469* (GH).

ORURO. Prov. Cercado, 8 km to Cochabamba, 3850 m, 22

April 1989, *Beck, Rugolo & Gomez-Sosa 18000* (SI); from Paria and Oruro to Caracollo, 3750 m, 13 February 1987, *Nee & Solomon 34117* (NY,MO).

Selected Specimens examined ARGENTINA

CATAMARCA: Depto. Andalgalá, El Candado, 5 Feb. 1917, *Joergensen 1125* (GH,BAB). Depto. Belén, Nacimiento de San Antonio, 2800 m, 23 Febr. 1981 (fl), *Cabrera et al. 32441* (SI); Sa. Culampajao, 2750 m, *Peirano s.n.* (GH,LILL 68653), Sa. Belén to El Tolar, 3000m, 1 Mar. 1939, *Schreiter 58535* (GH,SI). Depto. Poman, December 1909 (fl), *P. L. Spegazzini s.n.* (BAB 29104). Depto. Santa María, Feb. 1925, *Venturi 6689* (GH). Depto. Tinogasta, Quebrada de la Troya 2500 m, 24 February 1950 (fl,fr), *J. Hunziker & O. Caso 4058* (BAB).

JUJUY: Depto. Susques, 23°24'31 S 66°30'24" W, 3900 m, 16 Mar 1994 (fl.fr), *Mulgura et al. 1259* (MO,SI); Dept. Cochinoca, Abra Pampa, 3400 m, 19 Febr. 1929 (fl), *Venturi 9377* (GH,SI); 10 km south of INTA station, 23 February 1966, *Ledingham & Cabezas 4510* (MO); Cuesta Azul Pampa 3850 m, 21 February 1959, *Diers, L. 128* (SI); Cochinoca, 1 Feb. 1943, *Cabezas, V. s.n.* (SI); Depto. Humahuaca, Esquinas Blancas, 20 January 1976, *Cabrera et al. 27429* (SI); Humahuaca to Palca de Aparzo, 3900 m, 23° 12' S 65°13'W, 16 Feb. 1997 (fl,fr), *Zuloaga et al. 5930* (SI); Sa. del Aguila, 3700 m, 29 March 1929, *Venturi 8776* (GH,SI). Mina Aguilar, 4000 m, 12 Jan. 1948 (FL), *Cabrera 9173* (BAB); 7 Jan. 1950 (fl), *Schwabe 420* (BAB); Tres Cruces, December 1900-February 1901, *Claren 11317* (BAF); 3840 m, 23 Jan. 1982(fl,fr), *W. Anderson 12347* (NY); 3700 m, 20 February 1959, *Fabris et al. 1774* (SI); Depto. Tilcara, Yala de Monte Carmelo, 2900 m, 12-21 Jan. 1966 (fl) *Fabris 6415* (LP,NY); Depto. Tumbaya, bajada de Lipán, 3700 m, 15 Febr. 1980 (fl,fr), *Cabrera et al. 31.658* (SI); Depto. Valle Grande, Caspala, 3000 m, 25 December 1962 (fl), *Fabris 3610* (BAB). Depto. Yavi, La Quiaca, 24 Jan. 1940 (fl), *Meyer s.n. LIL 31536* (GH,LIL); Dpto. Valle Grande, slopes of Cerro Amarillo, near 3000 m, 2 Jan. 1978 (fl) *Kiesling & Ulibarri 1577* (SI).

LA RIOJA. Sa. de Famatina, Alto Blanco, 20 Jan. 1928, *Castellanos s.n.* (BA 28/189,GH); Quebrada de La Cumbre, 3500 m, 3 Apr. 1949 (fl-fr), *A. Krapovickas 6252* (BAB); Depto. Lamadrid, Puesto El Tebo, between Jagüel and El Leoncito, 2950 m, Jan. 24, 1949, (fl,fr); *A. Krapovickas & J.J.Hunziker 5549* (BAB).

MENDOZA. Depto. Las Heras, Portezuelo de Las Chilcas, 13 Dec. 1936, *Semper s.n.* (GH,LILL 4261); Casa de Piedra y Co Pelado, 2000 -2300 m, 19 December 1954, *Ruiz Leal 16474* (SI).

SALTA: Depto. Cachi, Descent from Piedra del Molino, ca.2800 m, 10 November 1978, *Renvoize 3415* (B); Cachipampa, 3135 m, 3 December 1960, *Ruiz Leal 21286* (IADIZA); 20 March 1982, *Varela 179* (SI, SALTA); Depto. Cafayate, La Laguna, 3900 m, 17 Jan. 1914, *Rodriguez 1354* (GH,BAB). Dept. Iruya, 22 Apr. 1989 (fl,fr), *Kiesling 7062* (SI). Depto. La Poma, 31 km E of Susques along 40 route, 23°25'53» S 66° 09' 54» W, 3440 m, 15 Mar. 1994, *Taylor et al. 11228* (MO-SI); Depto. Rosario de Lerma, Route 51, 3200 m, 1 Dec. 1986 (fl), *Novara & Charpin 5707* (SI, G); Campo Quijano, 1600 m, 17 Jan. 1929, *Venturi 8099* (GH); Puesto Tastil, 2800 m, 26 Jan. 1929, *Venturi 8165* (GH,SI); Depto. San Antonio de Los Cobres, slope Altos Chorrillos, 4000 m, 30 January 1944, *Cabrera 8300* (SI).

SAN JUAN. Depto. Angaco, Sa. Pie de Palo, 3000-3150 m, 23 Nov. 1984 (fl), *Kiesling 4775* (SI), to Mogote de Los Corralitos, 3350 m, 20 January 1981, *Kiesling 3105* (SI); Depto. Calingasta, Sa. del Tontal, 3500-3700 m, 22 January 1987, *Kiesling & Miglioli 6551* (SI); Depto. Iglesias, Cuesta de Las Casitas, 2300 m, 6 mar. 1937 (fl,fr), *R. Spegazzini 250* (BAB); Depto. Sarmiento, Rio Santa Rosa, 5 km from Rio de Los Leones, 24 January 1986, *Guaglianone et al. 1493* (SI); Depto. Zonda, Ea. Maradona, Agua Pinto, 9 February 1986, *Kiesling, Bacigalupo & Gomez-Sosa 6057* (SI).

TUCUMÁN. Depto. Chicligasta, Estancia La Pavas, 3300 m, 2 December 1926 (fl), *Venturi 4661* (BAB); Depto. Tafí del Valle, road to Amaicha, 1 Febr. 1947 (fl), *Schulz 6647* (SI). *Burkart 5392, 5394* (GH,SI); Cuesta de Los Cardones, near Amaicha, 2800 m, 30 January 1933, *Burkart 5382* (SI); ravine of Chorro, 3 400 m, Apr. 1926, *Venturi 4267* (GH,BAB); Cerro Muñoz, Ciénaga Grande, 22 Feb. 1905, *Lillo 4174* (GH,LILL 55295); La Ciénaga, without date, *Lorentz & Hieronymus 694* (SI).

Distribution, ecology, and phenology

(Fig.2 and 4).- Grows in the Andean region of Peru (Brako & Zarucchi, 1993), Bolivia (Pestalozzi, 1998), and Argentina (Johnston, 1947; Gomez-Sosa, 1994; 2000;) between 1600-4500 m elev. Flowering from November to April (Argentina), from January to December (Peru, Bolivia), and in fruit mainly during January to April (Argentina), and February to November (Peru, Bolivia).

A. garbancillo is know from collections made in Peru and Bolivia andis cited in many bibliographic references. It grows abundantly between 3500-4500 m, generally in grass steppe with isolated shrubs. Weberbauer (1945) cited localities from the Andean west slopes of central Perú, along the Pativilca river, in the Cusco valley along the Huatanay and Urubamba rivers, between 3500 to 3700 m, and in the Peruvian Andean central and southern Puna, between 3800 to 4000 m. The *A. garbancillo* grows in disturbed areas near human establishment and even in dung piles lett by llamas (*camelidos*) in overnight rest area. In the southwestern Andean mountains it occurs principally in the valley of

Titicaca Lake (Bolivia). For the Northwest of Argentina there are collections from the Provinces of Jujuy to Mendoza (Gomez-Sosa, 1999), especially in arid lands.

A. minor Clos, has been (Johnston, 1947) and is also considered here a species synonymous to *A. garbancillo*. The study of the type at Paris in floral phase, with the label only gives «Chile» as the locality, confirm that the whole aspect of the plant is that form of the species found in southern Peru, a region where C. Gay is known to have collected. Until now *A. garbancillo* has not been collected from Chile.

Astragalus garbancillo Cav. var. *mandoni* (Rusby) Macbride, Field Mus. Pub. Bot. 8: 100. 1930. (Figs. 1 S-T and 4)

A. mandoni Rusby, Mem. Torr. Club 3: 19. 1893. BOLIVIA. Mt. Tunari, near snow line, *Bang 1022*. 1891 (LECTOTYPE here designated: NY; ISOLECTOTYPES: BM, K).

In all resembling *A. garbancillo* var. *garbancillo* except for the apiculatus keel beak, as cited in the key above. Rusby cited two specimen, *Bang 1022* without fruit and *Mandon 709* with fruit, and no included fruit in his description or designation of a type, with the necessary lectotypication here.

Distribution and ecology

A. garbancillo var. *mandoni* occurs in Peru and Bolivia, in the same area of *A. garbancillo* var. *garbancillo*.

Additional selected specimens examined

PERU. Depto. Ancash, Prov. Bolognesi, hills W of Chieuián, 3880 m, 15 April 1949(fl,fr), *E. Cerrate 225* (UMS, SI).

BOLIVIA. Vicinis Sorata, 2690 m, *Mandon 709* (BM,G,GH,K,NY,P).

A. pickeringii Gray, Bot. U. S. Explor. Exped. 1: 415. 1854. (Fig.3)

PERU. Casa Cancha to Culnai, United States Exploring Expedition, Capt. *Wilkes 864*, 1838-1842. (HOLOTYPE: US; ISOTYPES: GH, K, P).

A. pickeringii var. *serpens* Ball, Jour. Linn. Soc. London 22: 36. 1885.

PERU. Ex regione superiori Andinum Peruviae, supra Casapalta, 4.000-4.300 m s.m., April 22, *J. Ball s.n.*, 1882 (HOLOTYPE: K; ISOTYPE G, GH).

Herbs with decumbent stems, ca. 0.20 m high; at apex internodes closed, with the stipules amplexicaulous, connate throughout >1/2 of their length, sheath shortly bidentate, membranous, sericeous, ciliate, 6-8 mm, closely imbricate on the upper stems; leaflets 17-23, short petiolate, articulate on little surface, opposite to subopposite, oblong to obovate, 4.5-5.0 x 2.0-2.5 mm, obtuse to retuse, base cuneate, sericeous on both sides. Peduncles (5)-7-15 mm; bracteoles 0; calyx 10-11 mm villose-woolly pubescent, tube campanulate, 6-7 mm, subulate-triangular teeth, 3-4 mm; petals light blue to violet; banner moderately recurved, obovate, emarginate, with short acuminate apex, (11) 14-16 x 6-7(9) mm; wings (11) 13-15 x 2.5-3.5 mm, rectangular retuse blade with claws ca. 7 mm; keel obtuse at apex, 9-11 mm; ovules 2-5. Legume ellipsoid, obtuse at base and apex, the stipe concealed in the hypanthial cup, disjoining from the receptacle, when mature, ca. 9 x 4.5 mm, woolly pubescent, dorsiventrally compressed, valves warped laterally, inflected below middle of pod, with complete septum, ripening upon ground; dehiscence unknown; seed ca. 2-4.

Distribution and ecology

(Fig. 4): *A. pickeringii* is endemic to Peru, Deptos. Junín, Lima and Huanuco, in gravelly slopes between 4400-4500 m, in Puna between 3750-4500 m in valleys and mountains on Jurassic limestone (Grant 7534 and 7560). Sometimes associated with *Azorella caespitosa*, *Distichia muscoides*, and *Chuquiraga oppositifolia* (Davison 9009).

Additional specimens examined: PERU. Without locality, 27 December 1878, *M. Martinet* 476 (P). **Depto. Huanuco.** Chasqui near Mito, 10 Apr. 1923, *Macbride* 3295 (FM); high plains near Junin, 3900 m, 1924, *Mackenzie* A. s.n. (FM).

JUNIN, Prov. Tarma-Jauja road, 26 km from Tarma, 75° 37' W 11° 34' S, 3960 m, 10 Jan. 1984 (fl), *D.N. Smith* 5704 (MO). Along road to Yauli off Lima. La Oroya, highway ca. 3 km from Yauli, elev. 4100 - 4260 m., 27 Jul. 1977 (fl, fr), *T. Duncan* 2655 (MO, NY); *Riccio & La Rosa* 614, 25 June 1966 (NY). Prov. Yaulí, Morococha, gravelly slope, 4400-4500 m elev., 9 June 1940 (fl, fr), *Asplund* 11519 (US); Route 20 A trans-Andean highway from Lima to La Oroya, km 125 E of Casapalca, 4340 m. Vegetation of *Azorella caespitosa*, *Distichia muscoides*, *Chuquiraga oppositifolia*, 11 Nov. 1979, *Davison* 9009 (NY). Pacha, near Oroya, 4100 m, 5 May 1948 (fl, fr), *P. Aguilar* s.n. (SI, USM). Highway La Oroya-Tingo María, 25,3 km, Puna, 3750 m., 3 Mar. 1977, *Boeke* 1076 (NY). Between Tarma and Jauja, 4500 m., Puna, 27 May 1929 (fl, fr), *Killip & Smith* 23370 (NY, US). Near Oroya, year 1918, *Kalenborn* 133 (G, NY, US). Slopes and bottom of the road of Quebrada de Jaluli, Hacienda Casa Blanca, ca. 18 km SSE of Tarma, 4000 m., 27 Dec. 1962 (fl) *Iltis et al.* 110 a (NY); Without locality, 27

Décember 1878, *M. Martinet* 476 (P). Copracancha Valley NW of Co. de Pasco, Common in slopes. Forming clumps. Flowers violet, nights freezing, open pampa with grass slopes vegetation. elev. about 4260 m, valley running North-S, glacial Jurassic limestone", 26 Apr. 1942, *V. Grant* 7534 (GH). Environs of Morococha, Pampa, 4420-4870 m Valleys and mountains on Jurassic limestone", 1 May 1942, *Grant* 7560 (GH).

LIMA, Río Blanco, 4500 m, 8-19 May 1922 (fl), *Macbride & Featherstone* 776 (FM); Shelby, 4050 m, 8 June 1922 (fl,fr), *Macbride & Featherstone* 1090 (FM). Prov. Huarochiri, Carretera Central near Casapalca, »Dry, high elevation grassland (Puna),« 3900 m, 10 May 1984 (fl), *D. N. Smith et al.* 6975 (MO,SI)

A. romasanus Ulbrich, Bot. Jahrb. 37: 421. 1906. (Fig.7)

TYPE: PERU. Prov. Cajatambos, Depto. Ancash. Encima de Pampa Roma, en el camino de Samanco a Caráz, 3400-3500 m, 30 May 1903 *Weberbauer* 3209 (HOLOTYPE: B, destroyed; LECTOTYPE, here designated: *A. Weberbauer* 3209 MOL; ISOTYPE: FM).

Decumbent, villous-pubescent herb, ca. 20 cm high and ca. 0.5 m diameter; stems with short internodes enclosed with amplexicaulous stipules, 4-5 mm long, connate through $>3/4$ of their length, sheath shortly bidentate, membranous, villous-pubescent to glabrescent, ciliate, 4-5 mm; leaves persistent; leaflets ca. 27, short-petiolulate, with glandular trichomes around the insertion area, elliptic, ca. 3.5 x 1.5 mm, apex obtuse minutely mucronate, base cuneate, adaxial glabrous, abaxial pubescent, conduplicate. Peduncles 1.3-2.3 cm long, erect, shorter than leaves; racemes congested 5-7- flowered; bracts triangular, pubescent, ciliolate, 4-5 mm long; pedicels ca. 1 mm long, ascending; calyx ca. 6.5 mm, villose, tube campanulate, 4 mm, teeth subulate, 2.5 mm; petals ochroleucous; banner slightly recurved, elliptic to ovate, emarginate ca. 15 x 6 mm; wings ca. 14 x 2.5 mm, with rectangulate obtuse blades, the claw ca. 7 mm; keel ca. 11 mm, claws ca. 6.5 mm; ovary pubescent, stipitate, stipe ca. 1.5 mm, stigma capitate; ca. 6 ovules. Legume bilocular, ellipsoid, base and apex obtuse short cuspidate, ca. 11 x 3.5 mm, laterally compressed, sericeous pubescent, inflexed below middle of pod, with complete septum; seeds 6-8, reniform, pale, mottled.

Representative specimens examined

PERU. **Depto. Puno**, May 1963 (fl,fr). *A. Vera* V. 037 (SI). Depto. La Libertad, Prov. Trujillo, La Taza, 2200 m, 26 July 1953 (fl,fr), *H. de Cevalco* s.n. (SI).

Distribution and ecology

(Fig. 6). Weberbauer (1945) cited localities of *A. romasanus* from the western slope of Central Andean Peru, in steppe level of grassland with dispersed shrubs, 3700 m, until Nepeña Valley, on the route through Cordillera Negra, Cajabamba and Pampa Romás town.

A. varus (Macbride) Gómez-Sosa, nov. comb. and status (Fig. 8 and 10).

A. garbancillo var. *varus* Macbride, Field Mus. Publ. Bot. 8: 99. 1930. TYPE: PERÚ. Station, 30 miles E of Huaráz, Poma Bamba, 4 Oct. 1922, *Macbride & Featherstone 2499*. About 4260 m. on dry stone slopes. Flowers whitish. (HOLOTYPE: FM).

Herbs glabrescent to glabrous. Stems decumbent, generally reddish, the internodes ca. 1 cm long, stipules membranous, glabrescent, 9-11 mm long, amplexicaulous and connate through more than half their length into a bidentate sheath, with triangular-subulate teeth 2-2.5 mm, pauci-ciliate; leaves ca. 7 cm long, petiole ca. 3.5-4 cm long.; leaflets 17-23, alternate to subalternate, shortly petiolulate with glandular trichomes around the insertion area, outlines oblong-ovate to lanceolate, shortly acuminate, glabrous adaxil, villose abaxial. Peduncles 1-1.5 cm long, recurved in fruit; racemes 5-7 flowered; bracts triangular-subulate, persistent; bracteoles filiform 1.5 mm; calyx ca. 8 mm long, black-subvillous, tube campanulate, ca. 5 mm, subulate teeth ca. 3 mm; petals whitish, banner moderately recurved, elliptic to ovate, emarginate short acuminate, ca. 13 x 6 mm; wings ca. 10 x 3 mm, blades rectangular, apex obtuse; keel ca. 9.5 mm, sometimes light blue; ovary pubescent, gynophore 1-1.5 mm, stigma capitate; ovules ca. 6. Legume reddish to black at maturity, elliptic, 5-7 x 3.5-4 mm, the stipe concealed in the hypanthial cup, disjointing from the receptacle when mature, obtuse at base, contracted at apex into 1-1.5 mm cusp, pubescent, complete membranaceous septum with apical sinus; dehiscence apical through the gaping beak; seeds ca. 4, 4.5 x 3 mm, reniform, smooth testa, brown, unmottled.

Additional specimens examined: PERÚ.

ANCASH, Conococha, 4100 m, top of divide on Pativilca-Huaraz road, 11 Jul. 1982 (fl, fr), *Gentry et al 37466* (MO). Prov. Bolognesi, cerros al W de Chiquián, 3880 m. 15 Apr. 1949 (fl), *R. Ferreyra 5774* (USM, SI); Hill Murquish, Ticllos, 3700 m, 25 May 1962 (fl, fr), *E. Cerrate 3985* (UMS, SI); Valle del Río Fortaleza, 2100-2300 m. 28 June 1966 (fl, fr), *R. Ferreyra 16877* (USM, SI); Pariarracra, Pampa de Lampas, Chiquián, 4160 m. 2 May 1952 (fl, fr), *E. Cerrate 1474* (UMS, SI); Prov. Cajatambos. Encima de Pampa Roma, en el camino de Samanco a Caráz, 3400-3500 m Prov. Huaraz,

Pitec, Quilcayhuanca, 3680 m. 1 June 1994 (fl,fr), *Gomez-Sosa & Carrillo Fuente*. 474 (SI, USM). Prov. Recuy, Huascarán Natinal Park, from Carpa to nevado Pasto-Ruri, 77°18' W 9° 6' S, 4130 m., 2 June 1994 (fl, fr), *Gomez-Sosa & Carrillo F.* 478 (SI,USM); 4020 m., *Gomez-Sosa & Carrillo F.* 479 (SI, USM).

AYACUCHO. 36 km E of Puquio, 4030 m, rocky puna, 22 Jun. 1978 (fl, fr), *Gentry et al.* 23289 (MO).

CAJAMARCA. Prov. Cajamarca. J.C. Mariátegui, 20-40 km on Sunchubamba-San Juan road. 3300-4000 m., 5 Jun. 1984, *D. N. Smith & I. Sánchez-Vega* 7561 (MO-SI).

JUNIN. Prov. Tarma, 12 Apr. 1963 (fl- fr), *C. Acleto* 689 (USM, SI).

Distribution and ecology

(Fig. 6 and 9).- *A. varus* is endemic to Peru, collected from Deptos. Ancash, Ayacucho, Cajamarca and Junin; grows on dry stone slopes and sand soils. Jalca with small patches of Ceja de Selva in rocky areas between 3300-4000 m Observed in revil of Quilcayhuanca, Province of Huaráz, on side of the road and near irrigation ditches. Abundant.

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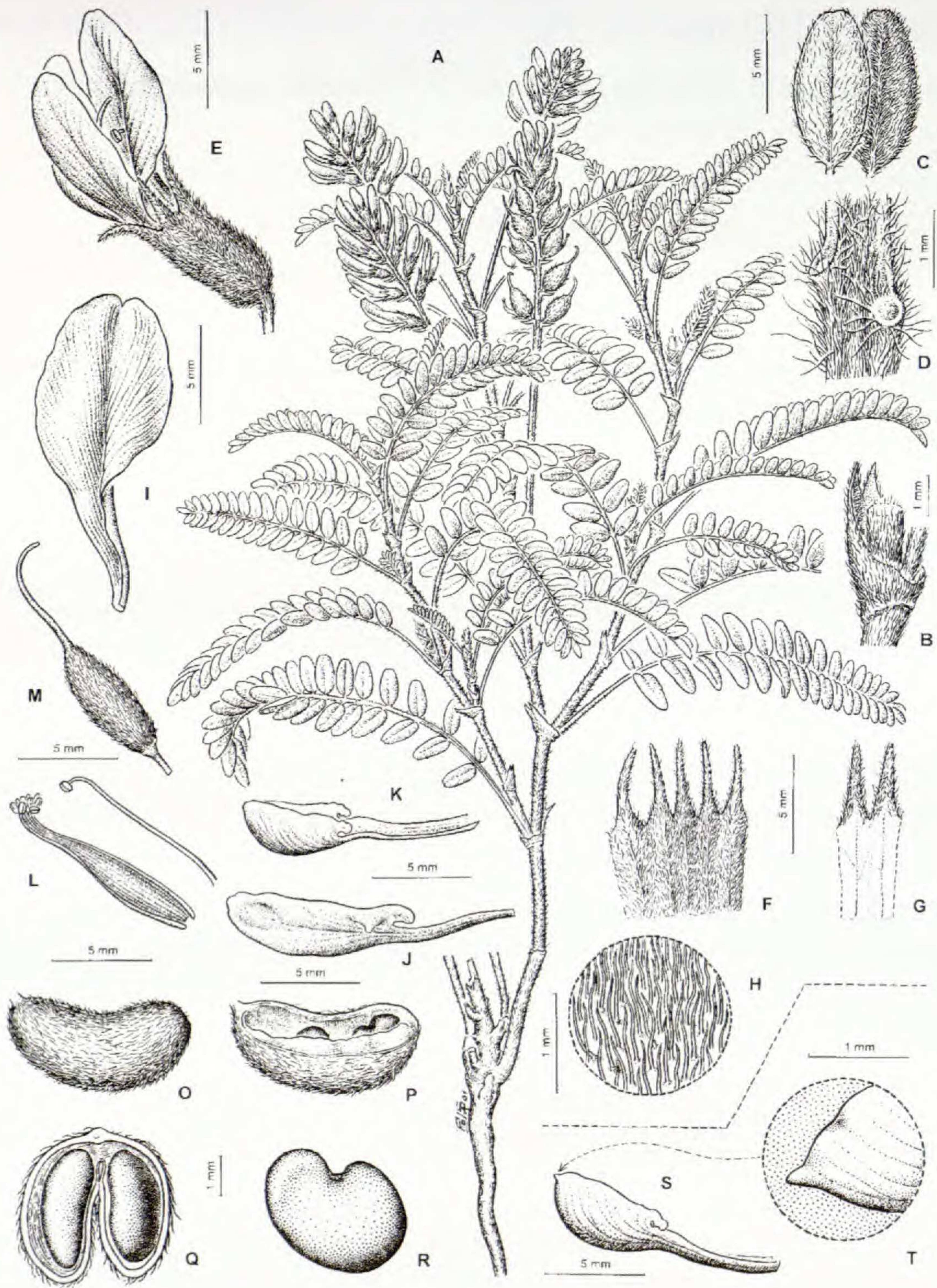


Fig. 1. *Astragalus garbancillo*. A. Habit of plant. B. Stipule. C. Leaflets. D. Rachis with petiolule surface insertion. E. Flower. F. Calyx. G. Internal surface pubescent teeth. H. Calyx pubescence. I. Banner. J. Wing. K. Keel. L. Androecium. M. Gynoeceium. N. Pod (profile). O. Fruit, longitudinal section, showing valves inflexed. P. Fruit, middle transverse section. Q. Seed. (Gomez-Sosa 480, SI).

Astragalus garbancillo var. *mandoni*. Keel at apex apiculatus. S-T. (Bang 1022, Lectotype, NY).



Fig. 2. *Astragalus garbancillo*. Habitat. (Gomez-Sosa 480, SI).

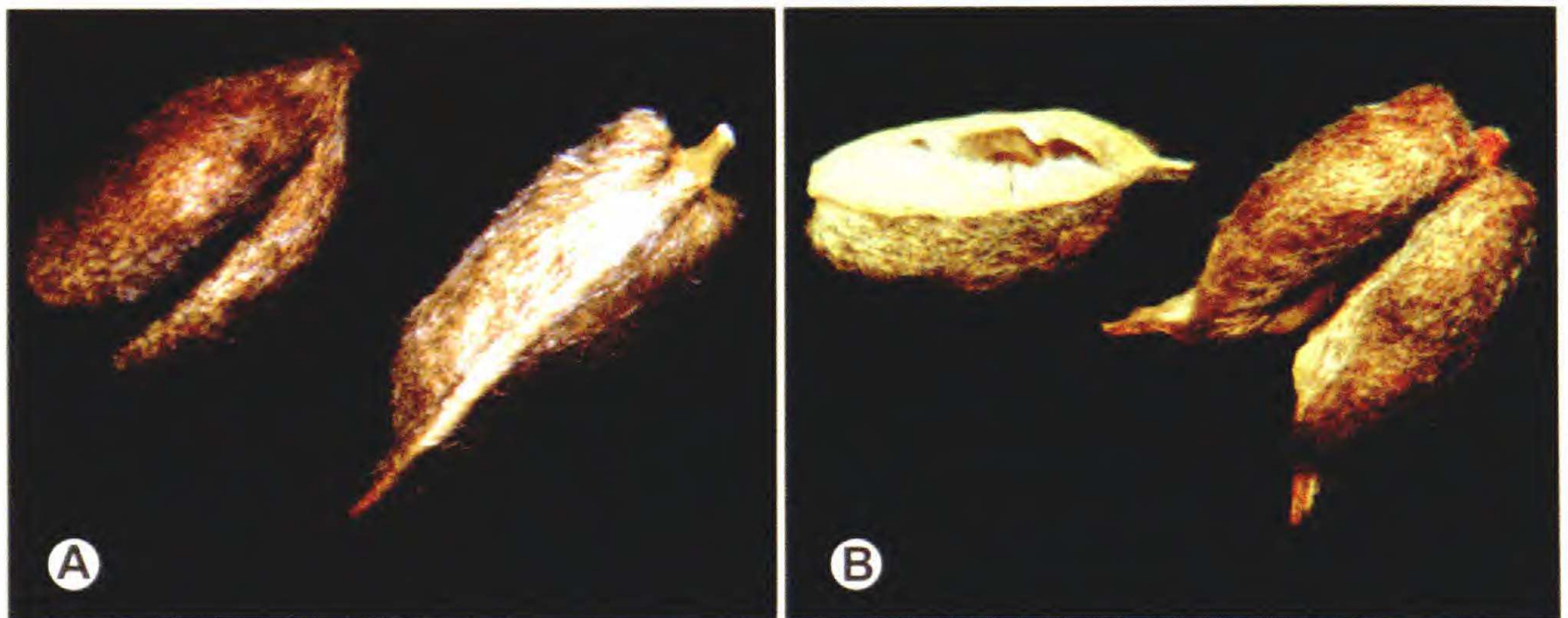


Fig. 3. *Astragalus garbancillo* A. Pod, infra and upper suture. B. Valves inflexed with an incomplete membranaceous septum and fruit in apical dehiscence. Peru, Cajamarca, (Gómez-Sosa 480,SI).



Fig. 4. South American distribution of *Astragalus garbancillo*.

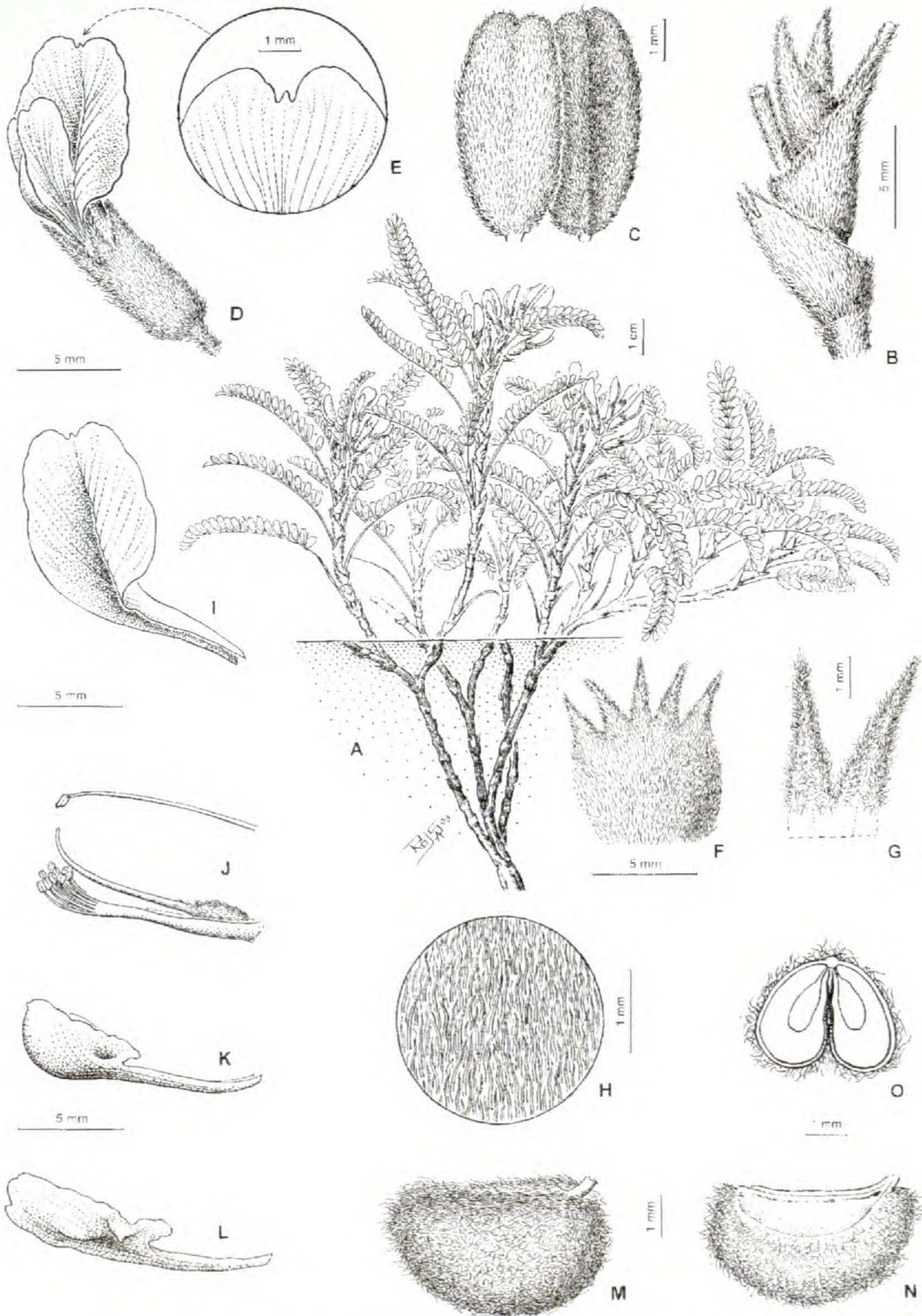


Fig. 5. *Astragalus pickeringii*. A. Habitat. B. Stipules. C. Leaflets. D. Flower. E. Banner emarginate, with short acumine apex. F. Calyx. G. Pubescent internal surface calyx teeth. H. Calyx pubescence. I. Banner. J. Gynoecium and androecium. K. Keel. L. Wing. M. Fruit (profile). N. Fruit, longitudinal section, showing valves inflexed. O. Fruit, middle transverse section. (Drawn from *A. Smith, Ferreyra et O. Tovar 6975, MO, SI*; *B-L. from Duncan 2655, MO, NY*).

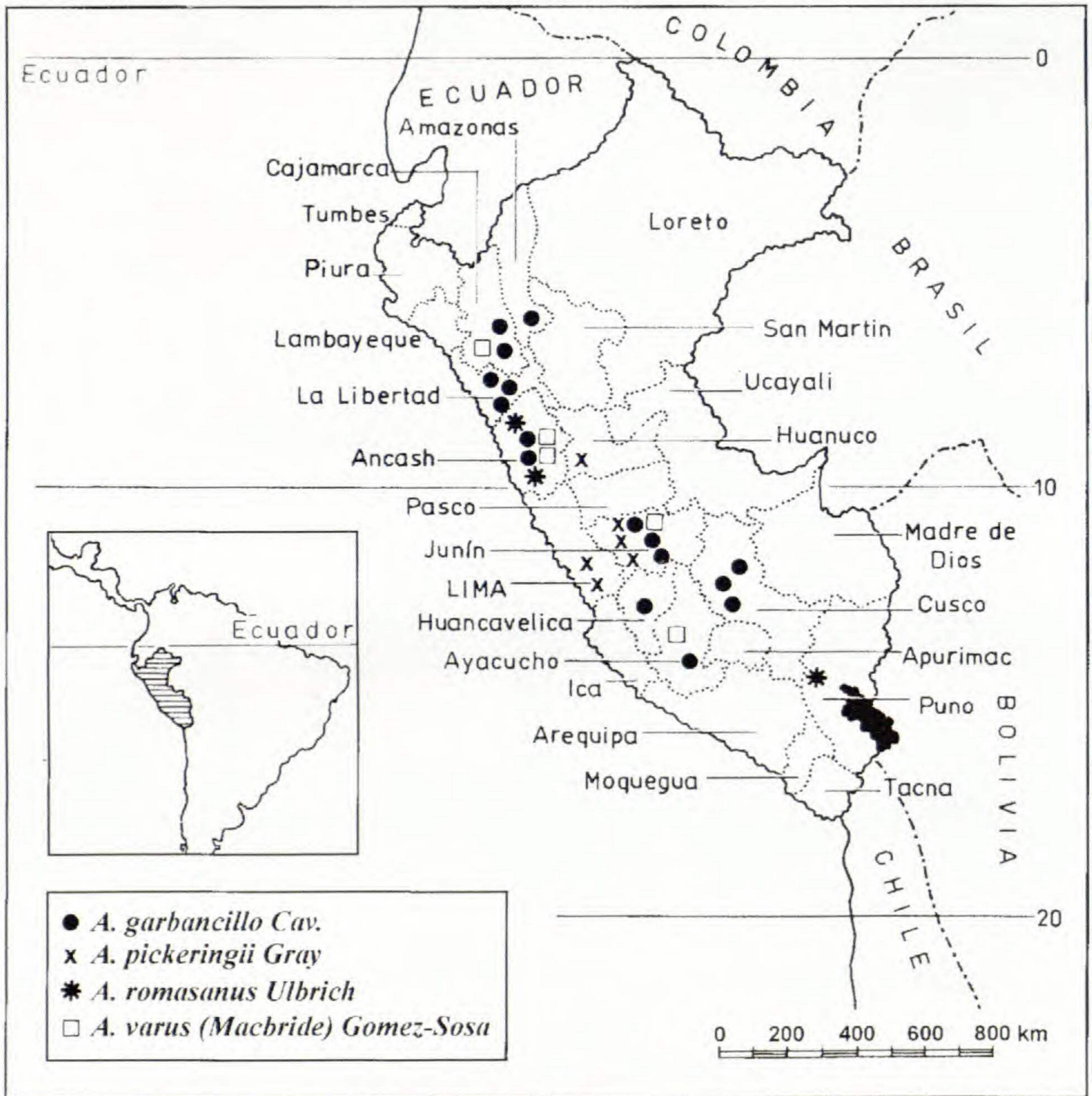


Fig. 6. Geographical distribution of *A. garbancillo* in Peru.

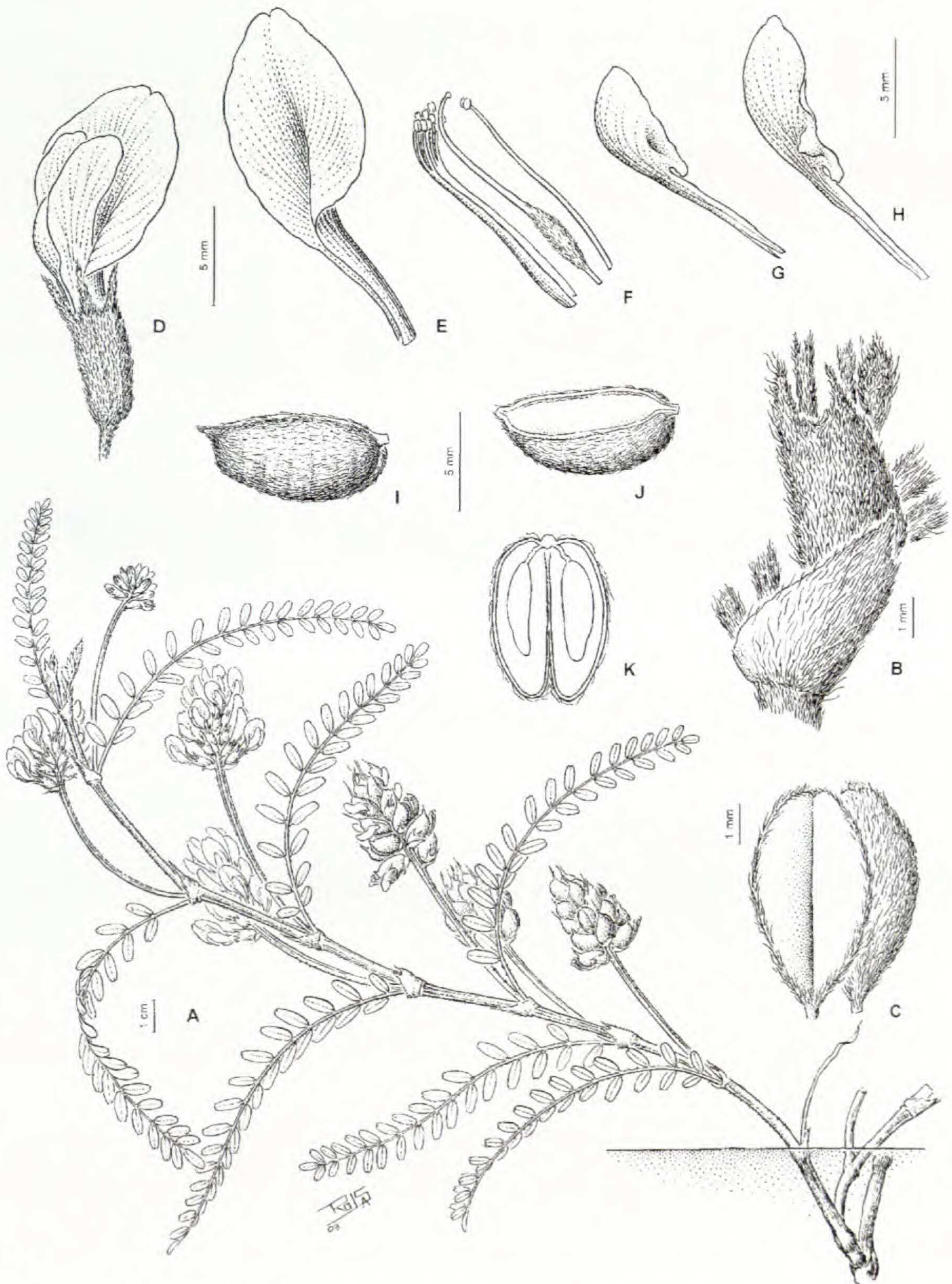


Fig. 7. *Astragalus romasanus*. **A.** Leafy branchlet with inflorescences and infrutescences. **B.** Stipules. **C.** Leaflets, pubescent adaxial and glabrous abaxial surface. **D.** Flower. **E.** Banner. **F.** Androecium and gynoecium. **G.** Keel. **H.** Wing. **I.** Fruit (profile). **J.** Fruit, longitudinal section, showing valves inflexed with complete septum. **K.** Fruit, middle transverse section. (Drawn from A, I-K, *A. Vera* 037, SI; B-H. Lectotype *A. Weberbauer* 3209, MOL).

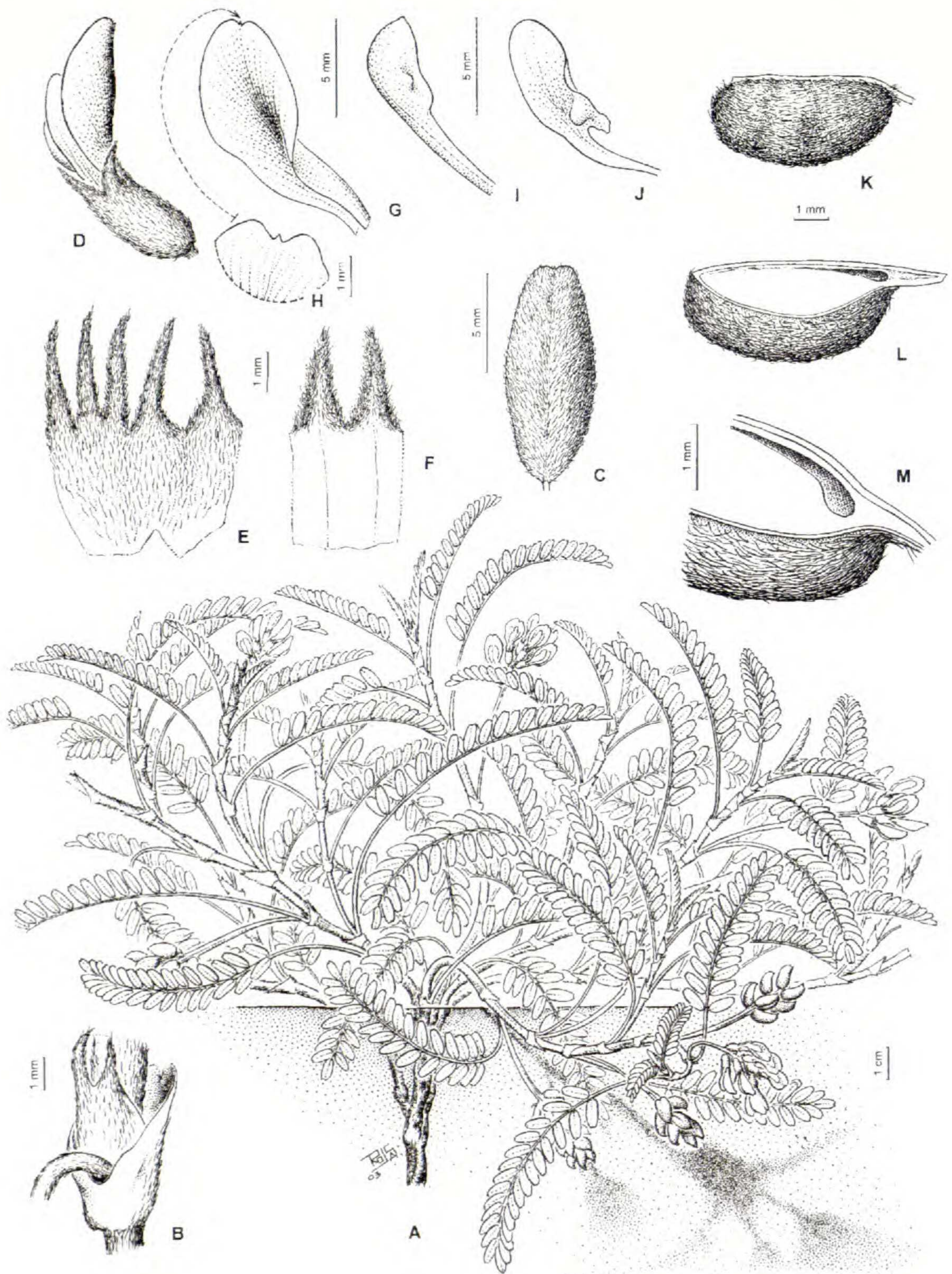


Fig. 8. *Astragalus varus*. **A.** Habit. **B.** Stipules. **C.** Leaflet. **D.** Flower. **E.** Calyx. **F.** Pubescent internal surface calyx teeth. **G.** Banner. **H.** Banner emarginate, with short acuminate apex. **I.** Keel. **J.** Wing. **K.** Fruit (profile). **L.** Fruit, longitudinal section, showing valves inflexed. **M.** Apical sinus incomplete membranaceous septum. (Drawn from A, Gomez-Sosa & Carrillo Fuentes 478, SI, USM. B-M, Macbride & Featherstone 2499, Types FM).



Fig. 9. Habitat of *Astragalus varus* (Macbride) Gomez-Sosa.

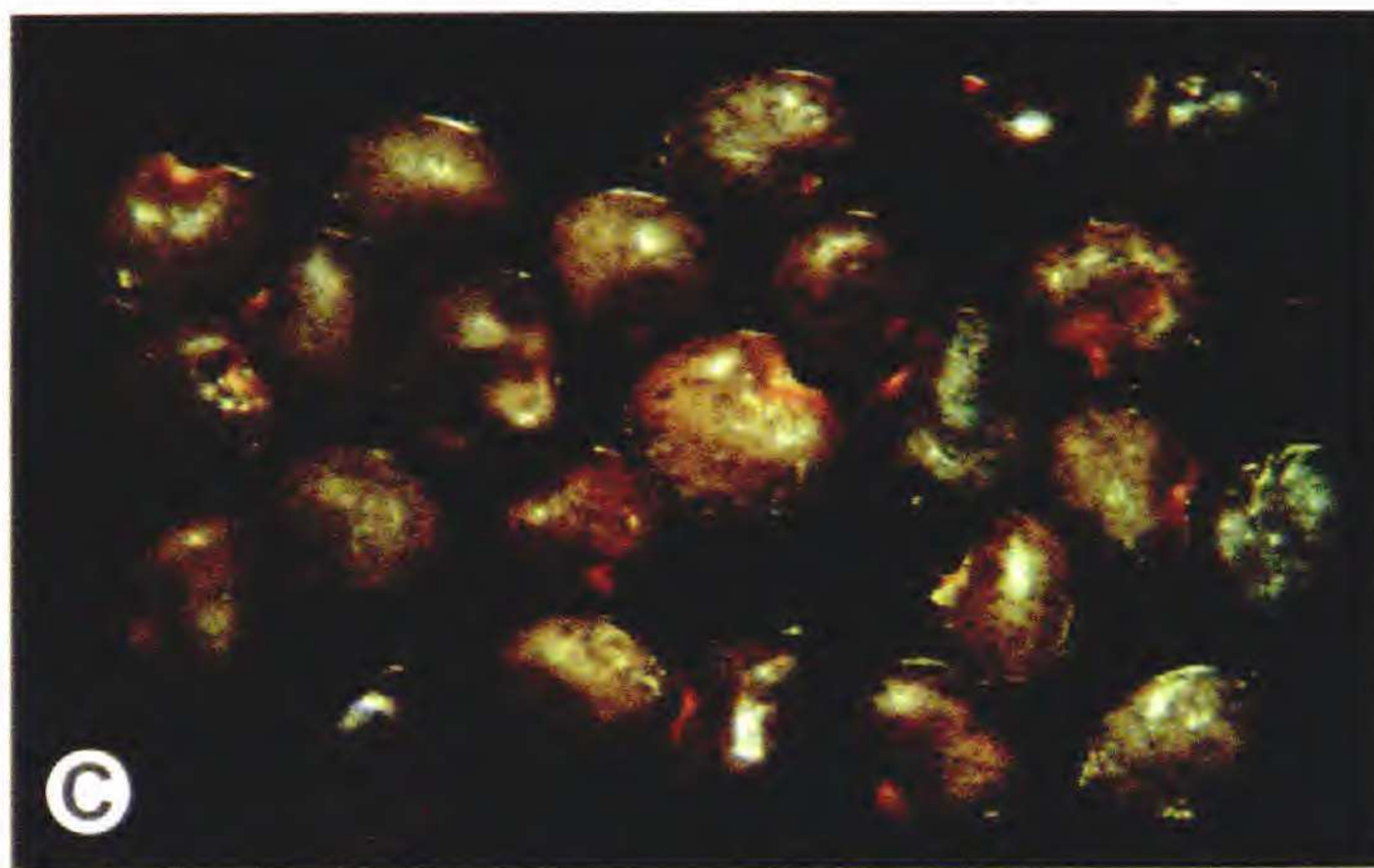
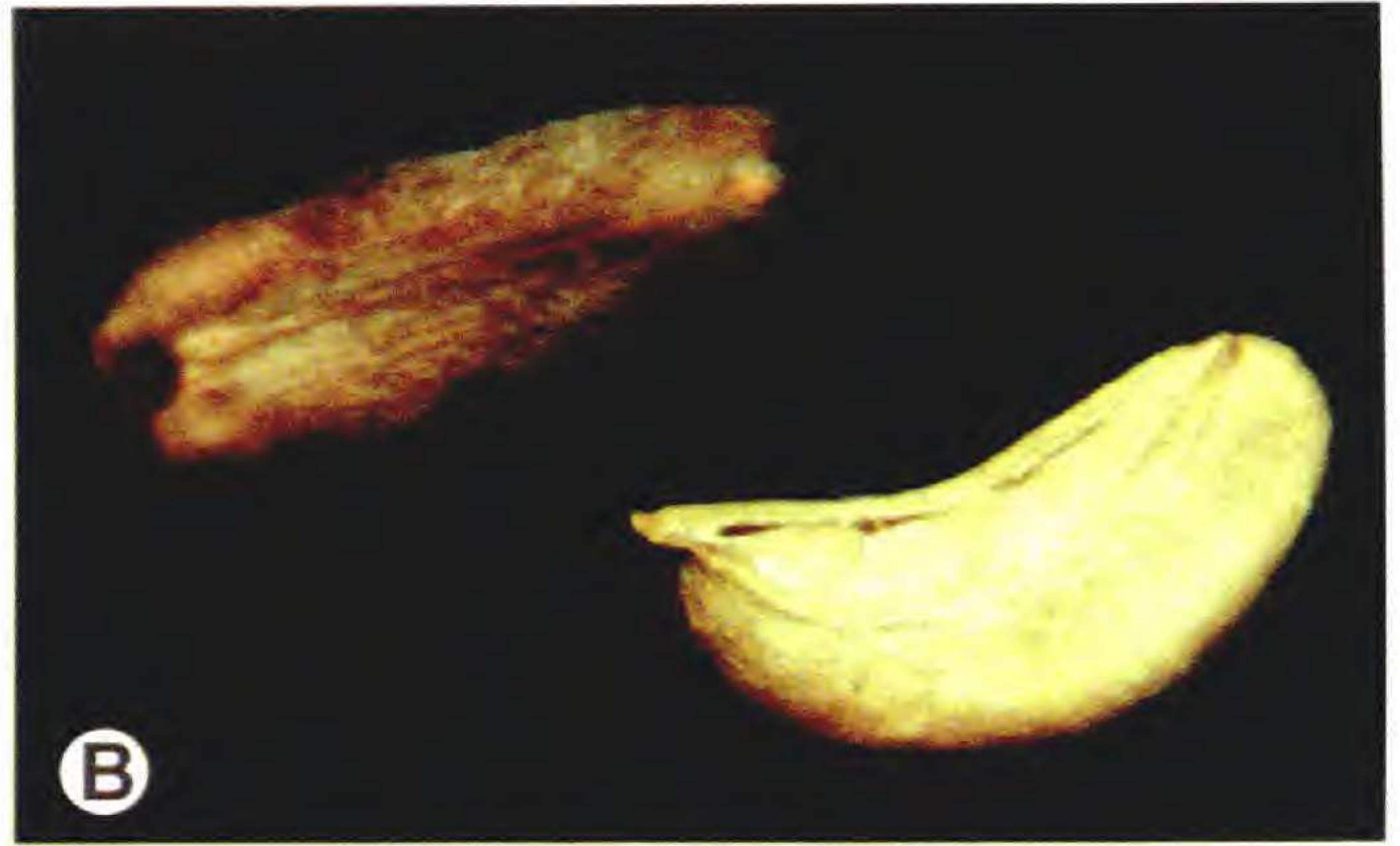


Fig. 10. *Astragalus varus* (Macbride) Gomez-Sosa. **A.** Infructescence at apex. **B.** Pod, upper suture and complete septum view. **C.** Seeds. (*Gomez-Sosa & Carrillo Fuentes 478, SI, USM*).

